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Review of Roadside Wildflower Programs and Assessment of Feasibility in Ontario

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Review of Roadside Wildflowe Programs and Assessment of Feasibility in Ontario

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Abstract:	This report describes the experiences of other jurisdictions in Ontario and the United States with establishing and maintaining roadside wildflowers. Wildflowers have been established by reduction of maintenance, management of natural stands, planting wildflower mixtures, and prairie restoration. There have been problems with species selection, lack of reliable seed or plant sources, weed control, maintenance requirements, and the need for renovation after a few years. Public acceptance has been favourable when aesthetic concerns are met and when weed control problems have not developed. Some jurisdictions have relied on public involvement in some aspect of wildflower planting, while others have been concerned about technical problems and potential liability. A number of options are identified for Ontario conditions, but research is required on approaches to wildflower establishment, species selection, climatic limitations, weed control, and self-sustaining plantings.
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ERRATA

Page 2, Line 9 - "one quarter to one percent" should read "one quarter of one percent"

Page 62, Line 33- "G. a. var. stritum" should read "G. a. var strictum".

Page 62 and 63 - The following citations have not been listed in the REFERENCES:

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Massachusetts Dept. of Public Works. 1989. Wildflower program evaluation. Final Report. Mass. Dept. of Public Works, Boston, Massachusetts. 40 pp.

Schramm, P. 1968. Practical restoration method for tall-grass prairie. In: Proc. of symposium on prairie and prairie restoration. Ed. P. Schramm, Knox College, Galesburg, Illinois. p. 63-65.

Strickland, D. and J. LeVay. 1980. Wildflowers of Algonquin Provincial Park. Ministry of Natural Resources, Toronto, Ontario. 31 pp.

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EXECUTIVE SUMMARY

The use of wildflowers in roadside landscaping in the United States has increased over the past two decades. In some states such as Texas, roadside wildflower displays have become a seasonal tourist attraction. These plantings have been developed by reductions in mowing and spraying in some districts, by management of naturally occurring stands, and by planting new areas in others. Many of the programs have developed as the result of a federal program for wildflower establishment and the nationwide "Operation Wildflower" campaign. Some jurisdictions have had overwhelming success with their wildflower plantings, while other have abandoned their projects after poor results.

A number of municipalities in Ontario have experimented with wildflower plantings with limited success. Plantings have failed due to weed infestations and poor plant establishment.

In the midwestern states, wildflowers have been planted as part of prairie restoration mixes containing native grasses and wildflowers. In other areas, plantings have consisted of wildflower mixtures. There has been a trend to use native or naturalized species and local seed sources where possible. There have been concerns about the lack of seed, cost of seed, seed quality, and disturbing natural populations.

A number of techniques have been used to establish wildflowers. Excellent results have been achieved with drill seeding, while hydroseeding has been the least successful technique for planting wild-

flowers. Since many wildflowers are biennial or perennial species, it has taken at least two to three years before the plantings flower on a regular basis. Problems have centred around weed control in new plantings, requirements for regular maintenance, and renovation of plantings.

In some jurisdictions, competitive self-sustaining wildflower communities have reduced roadside right-of-way maintenance costs. In other jurisdictions maintenance requirements, weed control, and renovation requirements have made these plantings expensive.

Generally, public response has been favourable as long as weed concerns have been addressed and when wildflowers have been used in suitable surroundings. Species selection and site selection should take into account weed concerns, cultural requirements, aesthetic quality, sustainability, and maintenance requirements.

There are a number of options that would be suitable for Ontario highway rights-of-way. Natural regeneration programs could target wildflowers as well as woody species. Naturally occurring stands of wildflowers could be identified and managed. Wildflower mixtures or prairie (grass and wildflower communities) mixtures could be established in selected sites. Special attention would have to be given to species selection, site selection, site preparation, choice of planting techniques, weed control, and long term maintenance requirements.

Wildflowers may be more expensive to establish than grass, but, if plantings become self-sustaining, they may require less regular maintenance in the long term. Other potential benefits of wildflowers include beautification of highways, increased public awareness of the natural environment, and increased enjoyment of Ontario highways by tourists and other drivers.

A few American states have involved the public in roadside management programs such as wildflower planting. Other states have been concerned about potential technical problems and possible liability.

Similar concerns would apply in Ontario. There is a need for the Ministry to develop the technology and fully understand the cultural operations before involving non-Ministry staff in such a program.

This report recommends that wildflower programs for Ontario highways be looked at in terms of management of naturally occurring stands and by establishing wildflower and prairie communities in selected sites. Research should initially address technical aspects such as wildflower species selection, climatic limitations, weed control, and establishing self-sustaining plantings.

1.0 INTRODUCTION

In recent years, wildflowers have played an increasingly important role in the roadside landscaping programs of several United States Departments of Transportation. Wildflowers have added beauty and interest to the roadside environment and may reduce maintenance costs (McCully, 1986). As a result of the interest generated by these programs in the U.S., the Ontario Ministry of Transportation (MTO) has received requests from Ministry personnel and the general public to institute a similar program.

In September 1987, the MTO commissioned the firm of Corush, Laroque, Sunderland and Partners Ltd. to study the feasibility of incorporating wildflowers in the Ministry's roadside vegetation management program for southern Ontario (Districts 1 through 9, south of Huntsville). This report summarizes those findings and includes some additional information on wildflower programs in other jurisdictions and relevant research.

2.0 WILDFLOWER PROGRAMS IN THE UNITED STATES

In many states, the use of wildflowers in highway landscaping programs began between 1973 and 1974 as a result of "Operation Wildflower", a program instituted in 1973 by the Federal Highway Administration in cooperation with the Federated Garden Clubs of America (Harper, 1988). One factor was the energy crisis of the early 1970's that severely increased the cost of mowing and spraying in the highway rights-of-way. This program was inspired by the Texas experience where Highway Depart-

ment personnel have encouraged wildflowers in the rights-of-way since the 1930's, adding beauty and interest to the highway environment and reducing the need for mowing (McCully, 1986).

In the nationwide "Operation Wildflower" campaign, state Garden Clubs donated seed and offered planting advice and state transportation departments provided labour and equipment. The program was judged to be successful in reducing maintenance costs and enhancing the appearance of state roadsides and, in 1987 the FHWA passed a regulation requiring all states to spend one quarter to one percent of Federal Aid Funds for highway landscaping on wildflower establishment with provisions for exceptions (Egan, 1988). Some form of wildflower planting has been done in over half the states. The following is a summary of wildflower programs in Texas, Minnesota, Nebraska, Massachusetts, Virginia, Michigan, Ohio, Illinois, and Florida.

2.1 Texas

The wildflower program has been in existence in Texas for approximately 55 years. The program began when a decision was made to delay mowing in the rights-of-way as a cost-saving measure. As a result of this practice, wildflowers began to appear naturally (McCully, 1986). These plants provided erosion control in areas where it was difficult to establish grasses and made a colourful visual impact. In addition to relying on natural regeneration, Texas State Department of Highways and Public Transportation personnel further developed new plantings by spreading cut wildflower hay or a thin layer of topsoil collected from established wildflower stands and containing wildflower seeds. Both

methods have continued to be used, although the development of commercial seed sources has made hydroseeding and broadcast or drill seeding techniques more economical. Nevertheless, wildflower plantings in Texas often have required reseeding during the first five to six years, before communities become well established and self-sustaining (M. Mathews, personal communication).

In 1982, a new vegetation management system further reduced summer and fall mowing and spraying in the rights-of-way. The new program resulted in a cost saving of 23% and the appearance of several wildflower species which had previously been suppressed (McCully, 1986). The changes received very favourable attention from conservationists and the general public. As a result of publicity, roadside wildflowers have become a major tourist attraction in the State.

The objectives of the vegetation management program in Texas (McCully, 1986) are:

1) To reduce the cost of maintenance and labour.
2) To create a sound native vegetation community on the highway.
3) To establish an unannounced right-of-way that blends rather than contrasts with its surroundings.

Wildflower planting in Texas has been very successful and has resulted in long term, stable communities of native plants in the rights-of-way. This has appeared to be partly due to climatic factors such as high temperatures, a long growing season, and periodic droughts which have aided the establishment of native wildflowers by limiting the

ability of grasses to dominate the ground cover. The main grass species in Texas rights-of-way have been warm season grasses, such as Bermuda grass, which do not compete with wildflowers in the spring. In contrast, in more northern states, the main grasses have been cool season species, such as Kentucky bluegrass, that grow most quickly in early spring when wildflowers are also competing for resources (R.L. Hundley, personal communication).

2.2 Minnesota (B.L. Harper, personal communication)

The Minnesota wildflower program evolved as part of the program of ecological management goals that was initiated in the late 1960's. "Simply altering the spraying and mowing policies has resulted in a five-to ten-fold increase in the wildflower population" (Ray, 1987). One prolific species has been Daucus carota (wild carrot or Queen Anne's lace) which is not considered to be a noxious weed as in Ontario.

During "Operation Wildflower" in the 1970's, the Minnesota DOT began deliberately seeding wildflowers in the rights-of-way. Initially, three rest areas with high public visibility were chosen for planting, with seed supplied by Minnesota garden clubs. Wildflowers became well-established at two of the three sites, although not all species germinated or survived.

In 1987, the DOT seeded five additional sites, ranging from one to three acres in size, to test various planting techniques. These sites included two rest areas, one tourist information centre, and two highway roadsides.

The major factor limiting the development of the wildflower program in the past had been the availability of locally-produced seed. Most seed had been purchased from suppliers in Texas and Utah, although the species planted were native to Minnesota. It has been suggested that plantings did not survive because these non-native populations may have been ill-adapted to the Minnesota environment.

Since 1987, two seed companies in Minnesota and a few small companies in Wisconsin have been able to provide small quantities of local grass and wildflower seed. The Minnesota DOT has also initiated a pilot project to encourage farmers to grow and sell the seed on contract.

In the past, most seeding has been fall hydroseeding on bare soil at construction sites (Ray, 1987). In general, results with hydroseeding have been poor, especially with local seed.

As a result, Minnesota now recommends drill-seeding for native grasses (B.L. Harper, personal communication) and is experimenting with drill-seeding of wildflowers directly into existing vegetation (Ray, 1987). All future plantings will attempt to use locally-produced seed.

2.3 Nebraska (E. Ronis, personal communication).

Following "Operation Wildflower", the Nebraska Dept. of Roads launched a research program to develop wildflower cultural techniques. The cost of plowing, spraying, and discing turfed areas prior to seeding was quite high and many technical problems were experienced with attempts to drill-seed directly into turf. All new seeding, therefore, has been restricted to construction sites.

In the 1970's, the NDOR conducted a research project with the Dept. of Horticulture at the University of Nebraska in Lincoln to develop local varieties of three wildflower species (Salac et al., 1978). Despite these efforts, the availability of locally produced seed in adequate quantities has continued to be a problem. Researchers at the University of Nebraska studied germination requirements of wildflower species and mowing practices (Salac et al., 1973; Salac and Hesse, 1975; Salac et al. 1978). They found that early season mowing of three wildflowers species reduced plant vigour and delayed blooming, but had a number of positive effects. Mowing forced laterals, produced plants of more uniform height, reduced lodging, and extended the period of bloom. Each species seemed to have an optimum date for mowing, which would make treatment of mixed stands more difficult.

2.4 Massachusetts (B. Francis, personal communication).
As in the case of Minnesota, the wildflower communities increased naturally along highways in Massachusetts as a result of reduced spraying and mowing in the 1960's and 1970's. Subsequently, in 1976, the state began developing a planting program to enhance the appearance of certain areas and a public relations program to educate the public about wildflower conservation.

Initially, the Dept. of Public Works conducted an analysis of existing wildflower communities in the right-of-way, including soil tests for nutrients and pH. Sites with similar soil conditions were chosen for test plantings. Thirty-five test plots were located along two interstate highways to evaluate wildflower establishment techniques. Final

site selection was made on the basis of location, visual benefits, and accessibility to workers (Falls et al., 1979). The study concluded that "wildflowers can be considered as a viable source of vegetation for roadsides in Massachusetts". Other conclusions of the study were:

1) Native species with multiple and bright coloured blossoms are preferred.
2) Wildflowers should not be used where highly competitive grasses have been established.
3) A satisfactory cover would occur more often if an initial site inspection could be used to identify areas with heavy or compacted soil or restrictive mowing schedules.
4) Dormancy requirements of certain species will require special handling therefore seeds of such species should be handled separately or omitted.
5) Wildflower species are not difficult to initiate by direct seeding with proper seed bed preparation, but two or more seasons are needed to determine if satisfactory establishment is attained.
6) It will take three to four years to observe complete establishment patterns.
7) Use of transplants is more expensive and labour intensive than direct seeding but plants may establish more quickly.
8) Fertilization and liming practices must be determined.
9) Mowing schedules can reduce reseeding if the frequency or timing of mowing prevents or reduces flowering.
10) Some areas may succeed to woody plants if maintenance is deferred.

As of 1987, approximately 120 ha (300 acres) had been planted in the test program. Most planting has been done by contractors, with some by Dept. of Public Works personnel with seed purchased from the U.S. southwest. Public response to the program has been very good but unfortunately many plantings have not survived longer than three to four years.

The final report on this program recommended (Mass. Dept. of Public Works, 1989):

1) Use of a new seed mix consisting of both annuals and perennials to provide sequential bloom and complimentary colour schemes.
2) Avoid the use of invasive species particularly ones that spread by stolons or rhizomes.
3) Renovate unsatisfactory sites using flail mowing (to replace rototilling) and drill seeding.
4) Preference for fall or early spring seeding.
5) Evaluation of the requirement for fertilization in future plantings.
6) Spot spraying of invasive weeds.
7) Reduction of mowing in selected rural sites to encourage development of wildflower meadows.

2.5 <u>Virginia</u> (R.L. Hundley, personal communication).

"Operation Wildflower" began in Virginia in 1973 with donations of plant material by garden clubs. In 1976, the DOT began a program of test plantings at 25 locations, with another 15 plantings in 1978.

All sites were planted in the spring. Some sites were treated with glyphosate (Roundup) and disced prior to seeding, while others were plowed and harrowed. Two of the 1978 plots were hydroseeded, while all other were broadcast seeded after seed bed preparation. All seed was purchased from suppliers in the southwestern United States.

Different mixtures of two or three species were planted. The results were variable in that some species persisted in some plots while others did not. The most successful species were Coreopsis lanceolata (lance-leaved coreopsis), Chrysanthemum leucanthemum (ox-eye daisy), Echinacea purpurea (purple coneflower) and Rudbeckia hirta (black-eyed Susan), all perennials. These species increased gradually in the plots over three seasons of monitoring. Plots that had been sprayed with glyphosate (Roundup) prior to seeding generally had as many weeds as untreated plots.

Since the most recent report available was published in 1978 (Coartney et al. 1978), no long term analysis is available. The 1978 report recommends further research on seed collection, germination and propagation of local populations, no-tillage planting techniques, and management of naturally-occurring wildflower communities.

Generally they have had variable success with their plantings. One factor has been competition in the spring between wildflowers and cool-season grasses. They have found that perennial species require several years to become established.

While the Virginia DOT has continued to plant wildflowers in the 1980's, they have been unable to develop commercial sources of local varieties because of the small market, and have continued to purchase seed from the prairie and western states. Mr. Hundley stressed the importance of involving the Department of Agriculture in approving the plantings and the species chosen before proceeding. They found it better if nearby farmers were informed of the project and if plantings were not located too close to cultivated fields.

2.6 Michigan (K. Herman, personal communication, Herman & Crispin, 1987).

"Operation Wildflower" began in Michigan in 1974 with plantings of Rudbeckia hirta (black-eyed Susan), Chysanthemum leucanthemum (ox-eye daisy), and Coreopsis lanceolata (lance-leaved coreopsis). These plantings were not very successful and the program was abandoned.

More than ten years later, in the spring of 1985, the Michigan DOT planted wildflowers in two small areas in interchanges with seed donated by the Federated Garden Clubs of Michigan. These plantings were quite successful, and the program has since been expanded to more than 70 locations, all near urban areas for maximum public visibility. It was felt that wildflowers were suitable near certain urban areas but that planting was too expensive for rural roads on a large scale.

Most of the species used were perennials which took two to three years to establish and produce flowers. A re-seeding was sometimes necessary after the first three years. Some of the most popular and successful

species have been Asclepias tuberosa (butterfly-weed), Monarda fistulosa (wild bergamot), Lupinus perennis (wild lupin), Coreopis sp. (coreopsis), Liatris sp. (blazing star), and Rudbeckia hirta (black-eyed Susan).

Spring planting in the past has now given way to more fall planting. Wildflower seeds and planting costs have been between $2500 and $7500 (U.S.) per hectare ($1000 - $3000 U.S./ac) depending on the site requirements. Native grasses, such as Andropogon scoparius (little bluestem) and Sorghastrum nutans (Indian grass), and Secale cereale (rye) have also been planted.

All wildflower seed has been purchased from commercial Midwestern producers. No seed has been collected in the wild. Although the garden clubs originally donated seed, the commercial seed proved too expensive for local groups to provide and the quality was not always up to the standards required by the Michigan DOT.

There has been criticism from scientists and conservation groups for planting imported populations. Recently, a program has been initiated by the Michigan DOT in coordination with the Departments of Agriculture and Natural Resources to work with the non-profit Michigan Wildflower Society in developing commercial production of local sources of both grasses and wildflowers.

At present, the Michigan DOT is attempting to reduce the amount of planting of seed from non-local sources. While planting of seed from local sources is being phased in gradually, expansion of natural stands is being encouraged by reducing right-of-way mowing in non-farming areas and by managing naturally-occurring wildflower populations. Since some of the most colourful wildflower populations have established naturally along the shores of the Great Lakes, primarily as a result of no mowing, the Michigan DOT is also looking at ways to develop or restore natural vegetative communities in roadside wetland areas.

In contrast with most practices, Michigan DOT does not plan to mow the wildflowers annually, but only once every four to five years to keep down woody invaders.

2.7 Ohio

In 1987, the Ohio DOT produced a feasibility study and recommendations for beginning a wildflower program (Wildseed, Inc., 1988). This study recommended fall seeding into turf or bare soil with no tillage using a rangeland type drill seeder (J-Thom 42 Wildseeder). This type of seeder opens a furrow into the existing sod and covers the seed with chains or tiner. Seed is placed in different positions within or ahead of the furrow according to size.

In turf areas, the existing sod was first killed with glyphosate (Roundup) and then mowed until it was reduced to a height of 2.5-3.8 cm (1-1 1/2 inches) before the seeding operation. Drill seeding was found

to increase seed germination by 15-20% over hydromulching with fibre on bare soil. It was suggested that this was due to improved seed/soil contact. Broadcast seeding by hand was recommended for small plots, and hydroseeding was recommended for large areas that were inaccessible to drills.

For any planting, it was recommended that existing weed vegetation be controlled with appropriate herbicides prior to planting.

The seed mixes used by the Ohio DOT have been composed of up to ten different species. Research has been conducted to determine the optimum seeding rates. The seeding rate for each species varied according to the size and weight of the seed.

It was found that seed quality was important in terms of botanical purity, germination, and vigour (a reflection of seed age). They recommended that seed inspection be done by a qualified lab before acceptance and/or before planting. With this information, planting rates would have been on a "pure live seed" basis, adjusting for purity and germination.

The use of postemergence grass specific herbicides was recommended for control of grassy weeds. Sethoxydim (Poast) was recommended for control of cool season grasses such as fescues and rye and fluazifop-p-butyl (Fusilade 2000) for warm season and rhizome-type grasses.

2.8 Illinois

The Illinois DOT has planted wildflowers for several years. Planting has been done primarily by contractors using a rangeland type drill seeder with a no-till attachment. Some locally produced wildflower seed has been available commercially in Illinois. Current wildflower seeding specifications for contractors have been described by the Illinois DOT (1987).

2.9 Florida (Evink et al., 1981)

In the 1970's, Florida DOT planted wildflowers using seed from the western states. However, many of the species that were planted were not adapted to the local climate and soils and died. As well, plantings failed due to poor seed germination and a lack of site preparation to reduce competitive weeds, especially grasses. This program has been cancelled but the state has reduced mowing and spraying operations to a minimum and has attempted to preserve and enhance naturally occurring populations of wildflowers in the rights-of-way.

2.10 California (E.N. Kress, personal communication).

The California DOT has not had a formalized wildflower program. Wildflowers have, however, been included in seed mixes planted for erosion control for many years, and are now part of every highway planting project. Occasionally, private groups have made requests to plant wildflowers in the right-of-way. These requests have been approved if the group satisfies the criteria for obtaining an encroachment permit.

2.11 Other Information

Doubrava and Raulston (1978) found that the application of pinestraw mulch following seeding of five wildflower species increased plant survival. As well, more plants survived with an April seeding, compared to May or June seeding.

Many researchers have reported that a range of pregermination treatments improved wildflower seed germination (Barnhill et al., 1983; Nichols, 1934; Nuzzo, 1978; Salac and Hesse, 1975; Threlfall, 1982; Zajicek et al., 1986). The publication "Resources on Wildflower Propagation" (Sullivan and Daley, 1981) has compiled the seed treatments used by various workers for an extensive list of wildflower and native grass species. In the absence of seed pre-treatment facilities, fall planting has been employed to provide a natural cold treatment.

3.0 WILDFLOWER PROGRAMS IN ONTARIO

Several agencies have attempted to establish wildflowers as part of their landscaping programs with varying success. All direct-seeding programs have used commercial seed mixes produced in the western U.S. Some small trials have used locally produced seedlings (Mulligan, personal communication). No projects in Ontario have involved donations from the general public.

3.1 National Capital Commission, Ottawa (G. Lajeunesse and W.R. Aimers, personal communication)

The NCC has been including wildflowers in park landscaping operations for several years. Aimers' "Wildflowers en Masse" commercial mix of

annuals and perennials has been used in several locations. Wildflowers have been hydroseeded on prepared sites with a fibre mulch and a nurse crop of clump grass.

They have had problems with the wildflowers becoming overgrown with weeds in the first two years and have concluded that eliminating existing weeds and allowing weed seeds to germinate in the soil before planting was essential. Deep tillage (at least 15 cm (6 inches)) followed by a fallow period has been suggested as one way to achieve a degree of weed control. They also found that species should be chosen that are suitable for the environmental conditions at each site, particularly soil moisture and degree of shading.

Although the recommended seeding rate for Aimers' "Wildflowers en Masse" was 5 kg/ha, they found that it was advisable to sow up to 10 to 12 kg/ha in at least the first season to ensure a good bloom.

Fall planting resulted in annuals in the mix germinating during a warm period in the fall and then being winter-killed; this was not a problem with spring plantings. The annuals bloomed very well for the first summer, but did not re-seed themselves during the following season. The perennials produced only vegetative growth in the first summer, but gradually became dominant in following seasons. Some perennial species required a cold period before they would germinate and if spring planted, did not bloom until the third season. Different species dominated during successive years.

Some of the most successful species have been Achillea millefolium (common yarrow), Oenothera biennis (yellow evening primrose), Solidago spp. (goldenrod), Echinacea purpurea (purple coneflower) and Lupinus spp. (lupines). In one of the older plantings, most species have died out with the exception of the yarrow, and have been invaded by weed species. The other, younger plantings have required no maintenance other than a yearly fall mowing after seed has matured. Mowing has usually been done after the first freeze (late October-November).

In fall 1989, they were experimenting with direct seeding into existing sod. The species that were used were ones that have been observed to be naturally occurring on roadsides (B. Hosler, personal communication).

Public response to these plantings has been very favourable. There was some disappointment however, when the first summer's showy annuals did not repeat themselves in subsequent years. They emphasized that care should be taken to ensure that the wildflowers "fit in" aesthetically with the surrounding landscape since wildflower plantings may appear "rough" or "ragged" in the spring and fall. They have had poor public response to some attempted "natural regeneration" sites in parks in areas where the surrounding lawns are very well-groomed.

3.2 City of North York (B. Nicolson, personal communication)

Havenbrook Park (area planted - 1-1.5 ha)

Two of Aimers' wildflower mixes were sown on hillsides in 1982. The existing turf grasses were initially killed in early May with gly-

phosate (Roundup) and the area was rototilled approximately 10 days to 2 weeks later with no fallow period before planting. Seed was broadcast using a cyclone seeder along with a nurse crop of clump fescue.

The annuals and bunchgrass appeared in the first year, with perennials gradually increasing in subsequent years. A different species appears to have dominated every year. Some of the most successful species have been Oenothera biennis (evening primrose), Echinacea purpurea (purple coneflower), Rudbeckia hirta (black-eyed Susan), Chrysanthemum leucanthemum (ox-eye daisy), Achillea millefolium (yarrow), Alyssum maritimum (sweet alyssum) and Lathyrus sp. (perennial sweet pea).

Maintenance has been a yearly fall mowing. Dandelions have now invaded the plots and it has been recommended that areas around future planting sites be treated with herbicide prior to planting to reduce seed sources of this and other broadleaved weeds. As well, fallowing after tillage has been suggested to reduce weeds by allowing weed seeds to germinate. At one site, sumac and other woody species such as ash have invaded from a nearby woodlot. Some species of wildflowers have been dying out and the municipality has considered reseeding in the future.

Park officials have generally been pleased with the results of the project and public response has been good to neutral. The only problem was during the first summer, when one site had to be hand-weeded when invading ragweed resulted in complaints from an adjacent landowner who suffered from allergies.

3.3 Town of Oakville (R. Norman and W. Clancy, personal communication)

Glen Abbey Development (area planted - 4-6 ha)

Several wildflower plantings have been established in and around the Glen Abbey development near Oakville, Ontario. The sites have included large berm areas, park open spaces, and woodlot edges. Both Aimers and Pickseed wildflower mixes have been used. On construction sites (clay fill), four to five inches of topsoil was brought in and seeded directly with no further preparation. Turfed areas were sprayed with glyphosate (Roundup) and then tilled and seeded two weeks later. All seedings included a nurse crop of clump fescue. Seeding was done in the spring. Fall seeding was not recommended due to the concern about fall germination and subsequent winter kill of annual species.

After four or five seasons the plantings were still vigorous. Generally, sunny, dry, open sites have done better than shaded. Previously turfed areas have had little problem with invading weeds, while construction sites have generally produced poorer results because of weed seeds in the topsoil. Perennials and biennials have gradually taken over from annuals and the dominant species have varied from year to year.

The only maintenance has been a yearly fall mowing after seed maturity. It was felt that this improved the appearance of the plot as well as ensuring that seed heads came into contact with the ground. Some of the more successful species included Achillea millefolium (yarrow), Chrysanthemum leucanthemum (ox-eye daisy), Coreopsis lanceolata

(lance-leaf coreopsis), Echinacea purpurea (purple coneflower), Linum perenne (blue flax), Linaria sp. (toadflax), Oenothera biennis (evening primrose), and Rudbeckia hirta (black-eyed Susan).

3.4 Transport Canada (Corush et al., unpublished report)

Hamilton Airport (area planted - 0.4-0.8 ha)

This project began in the mid 1980's when the Hamilton Airport underwent reconstruction. The wildflower site was an exposed flat area adjacent to the entry road. Wildflower seeds were broadcast over exposed topsoil areas in mid-July with no accompanying weed control measures. By the first fall only two wildflower species had established, Anenome sp. (wild poppy) and Rudbeckia hirta (black-eyed Susan).

The following spring the contractor was brought back to re-seed the initial planting area and a number of wildflower species emerged. By this time, however, the program was coming under much public criticism and many complaints were filed regarding the Airport's unkempt and unsightly appearance. Therefore, in the fall of the second year, the entire area was mowed. The following spring wildflower species emerged but there was invasion by grasses. Again in the third year, there was public concern about the appearance of the Airport. As a result, the entire wildflower area was mowed from early summer on, in essence ending the wildflower program.

3.5 Ontario Hydro (Corush et al., unpublished report)

Ontario Hydro experimented with wildflowers on restoration sites near Kincardine and Newcastle, Ontario in the early 1980's. Wildflower

seeds were broadcast over exposed restoration sites. Pickseed Wildflower mix was used and sown with a nurse crop of sheep fescue or "Tournament" hard fescue. Prior to seeding, no weed control measures were taken. Once the wildflowers were established, accessible areas were rough cut in the fall of each year.

On most sites the wildflowers flourished for the first two years with the most noticeable species being Ratibida pinnata (prairie coneflower), Rudbeckia hirta (black-eyed Susan), Petalostemum purpureum (purple prairie clover), and Coreopsis lanceolata (lance-leafed coreopsis). After two years, many of the wildflowers declined. Notably some wildflowers persisted on exposed granular sites, apparently due to the lack of competition from weed species.

In no situation have the wildflowers attained the anticipated dominance. As a result, Ontario Hydro has not developed a comprehensive wildflower policy or program.

4.0 NATURAL REGENERATION OF ROADSIDE VEGETATION

In many U.S. states, the reduction or elimination of mowing and spraying in the right-of-way has allowed native wildflower and grass species to become established. The Michigan DOT has experimented with management techniques to encourage natural regeneration of desirable wildflowers while reducing wildflower planting. One concern has been that many of the so-called "native" wildflowers are imports from Europe or Asia which have adapted and become naturalized.

Reductions in mowing and spraying have occurred in Ontario as part of a natural regeneration program. For example, in several areas of the right-of-way in District 5 (Owen Sound), mowing and spraying have been suspended since 1976 and natural vegetation has been allowed to regenerate.

Ground coverage was an established grass/legume mix when the program began. Common wildflowers that increased in this area included Daucus carota (wild carrot or Queen Anne's lace), Hyperium perforatum (St. John's-wort), Solidago spp. (goldenrods), Achillea millefolium (yarrow), Oenothera biennis (yellow evening-primrose), Rosa sp. (rose), Fragaria virginiana (strawberry), Cichorium intybus (chicory), Senecio jacobaea (tansy ragwort), Verbascum thapsus (common mullein), Linaria sp. (toadflax), Dipsacus sylvestris (teasel), Chrysanthemum leucanthemem (ox-eye daisy), Sinapsis arvensis (wild mustard), Echium vulgare (blueweed) and thistles.

Only evening primrose, goldenrod, and wild strawberry are considered native to Ontario (Fernald, 1970). A number of thistle species and wild carrot are classified as noxious weeds under the Ontario Weed Control Act (1988) and St. John's-wort may cause photosensitization if eaten by livestock.

The effectiveness of reduced mowing and spraying alone in the return of desirable native wildflower species to roadside rights-of-way depends on natural seed stocks and adjacent seed sources. It may be possible, however, to develop management practices that would enhance desirable species in these locations while reducing noxious weeds. These might

include a combination of low mowing, selective herbicide application, and overseeding or spot transplanting with desirable wildflower species appropriate to the site conditions.

5.0 ROADSIDE PRAIRIE RESTORATION

In a number of states such as Illinois, Iowa, Nebraska, and Wisconsin, wildflower planting has been done in conjunction with prairie restoration on roadside rights-of-way. This has involved establishing communities of native prairie grasses and flowering forb species. Forb is a term used to describe broad-leaved flowering plants, as distinguished from grasses and sedges.

The restoration of prairie communities has been occurring in states that were naturally occupied by tallgrass prairie or prairie-forest transition regions as described by Costello (1969). A few disjunct prairie communities have been described in Ohio and New York States as well as in southwestern Ontario and a small site in eastern Toronto (Pratt, 1980; Roberts et al., 1977). The Ojibway Prairie Provincial Park, located in the municipality of Windsor, has preserved a unique remnant of tall-grass prairie. As well, Lumsden (1966) reported the occurrence of prairie-like soils in certain areas of southwestern Ontario.

This suggests that one possible approach to roadside wildflower establishment in Ontario may be planting of prairie or prairie-like communities, particularly in southwestern Ontario.

A number of planting techniques have been used for prairie restoration, ranging from clearing and broadcast seeding large areas, to seeding or transplanting plants into existing or killed sod (Landers et al., 1968; Nuzzo, 1978; Schramm, 1978; Zajicek et al., 1986). Nuzzo (1978) found that transplanting seedlings of prairie plants into prepared spots in existing sod permitted treatment of larger areas with less plant material and at a lower cost per area basis than would be possible by seeding.

Various planting times have been employed from spring to late June to fall (Landers, 1972; Nuzzo, 1978; Schramm and Kalvin, 1978). Water supply was a limiting factor with late spring plantings. Zajicek et al. (1986) concluded that it depended on the species as to whether spring or fall plantings were more successful. Fall plantings resulted in larger plants by the end of the first growing season as compared to spring plantings. For some species, fall planting allowed natural stratification to occur before spring germination.

Ode (1968) compared the use of straw, hay, or no mulches in broadcast seeding of prairie grasses and forbs. He found that in most cases, the use of mulches provided no benefit in establishment compared to seeding without mulch.

Weeds offered the most competition with young prairie plants during the first few years. Schramm (1978) recommended planting with minimal disturbance so that weed seeds were not exposed and induced to germinate. Where tillage was used, he suggested using a stale seedbed

technique, that is allowing weed seeds to germinate and then controlling them, before a late spring planting. Grass weeds and deep rooted perennials were very competitive with prairie plants. Landers et al. (1968) observed that weed-free plots grew better and flowered sooner than plots infested with foxtail or plots with a wheat cover crop. When prairie plants were planted using sod transplants, established perennial grasses such as bluegrass and smooth brome offered strong competition during the first year (Landers et al., 1968). It was observed that it took three to four years before the prairie species began to dominate the plantings (Landers, 1972; Woehler and Martin, 1980) and weed competition was less of a concern. This coincided with the decline of the annual weed species.

Maintenance of prairie plantings has involved the application of prescribed burns, mowing, selective weed control, or combinations of these to rejuvenate the plantings and to control invading weeds, particularly woody species. Burning of prairie communities every two to four years has simulated "the wildfires that favoured prairies" in earlier centuries (Harper, 1988). The burns have been effective in removing woody weeds and cool season weeds such as bluegrass as well as removing above ground litter (Ode, 1972; Schramm, 1978). The underground stems of the perennial prairie grasses and forbs were not injured by the fire. Schram (1968) suggested that burning should be done in early spring rather than reduce winter wildlife cover with fall burns.

Prescribed burns have been used to some degree to maintain roadside prairie communities in Minnesota (Harper, 1988). Ode (1972) pointed out that burns may be easy to control on "long narrow strips such as road shoulders [and]...will not produce much smoke." Where prescribed burns have not been possible, late fall mowing and spot applications of herbicides have been effective in controlling invading weeds in prairie plantings (Harper, 1988; Ode, 1972). Kettle and Fitch (1980) reported that late July mowing of a prairie prevented invasion by weedy trees and shrubs although the mowing treatment did not maintain as diverse a community of flora as a spring burning treatment.

6.0 SUMMARY OF PAST EXPERIENCE

Planting wildflowers has been tried in a number of jurisdictions with variable results. Some jurisdictions have had overwhelming success with their plantings, while others have abandoned the projects after poor results.

Many different methods of establishment have been used. These have included use of natural regeneration (or reduced maintenance), management of natural stands, planting of wildflower hay, spreading soil containing wildflower seed, broadcast and hydroseeding into prepared sites, drill seeding into tilled sites or existing sod, and transplanting into prepared sites or existing sod. Hydroseeding has generally not been successful, likely due to poor seed/soil contact. Drill seeding has been widely pursued because of the ability of rangeland or grass drills to handle the light-weight and variable sizes of wildflower seed and to seed into existing or herbicide-killed sod with

no soil preparation. Even in prepared seedbeds, drill seeders have provided the seed/soil contact that seems to be necessary for good germination.

Transplanting wildflowers into prepared spots in existing sod has allowed forb enrichment (Schramm, 1978) of grassland roadsides. Other jurisdictions have found that encouraging natural regeneration in sites with existing wildflower seed sources and managing natural stands have been cost- effective methods for establishing wildflowers.

In response to concerns by ecologists and naturalists, local seed sources have been used where possible. There have been problems with lack of seed, cost of seed, seed quality, and concerns about disturbing natural populations. Alternatively, commercial seed, usually from midwestern producers, has been used. Another problem has been poor survival of species not adapted to the climatic conditions of the area being planted. Hardiness may have been a problem with survival of perennial species.

Generally, wildflower plantings have taken several years to establish and flower on a regular basis. The main factor has been the use of perennial species. Annual species have been included to provide floral displays in the first year. Reseeding has been necessary where perennial plant survival was poor and where annual wildflowers have not reseeded adequately.

Weed competition has been a major concern during the first few years, especially by naturalized Eurasian weed species and established perennial weeds. As well as being very competitive with the wildflowers, weed growth has made the plantings unsightly. Methods of weed control that have been recommended have been minimal soil disturbance during the planting operation, use of a stale seedbed technique, and use of chemical weed control. It was observed that in successful prairie plantings, the Eurasian weed species decreased in number after the first three to four years as the perennial plants grew and reproduced.

Maintenance has been necessary to control invading weed species, especially shrubs and trees. In prairie plantings, this has been accomplished by the use of controlled burns. In other situations, regular mowings at least once, late in the growing season, have successfully controlled invading weeds, improved the ragged appearance of plantings, and distributed seed heads on the ground.

For some regions, wildflower plantings have resulted in reduced maintenance costs due to the competitive, self-sustaining wildflower communities or due to reduced maintenance programs. Other jurisdictions have found that the continual reseeding and maintenance requirements for their plantings have been equally as expensive as or more expensive than establishing and mowing turf.

7.0 PUBLIC PERCEPTION

7.1 Aesthetics

The reaction of the general public to wildflower plantings, both in Ontario and the U.S., has been very positive in most cases. There has

been public interest in the environmental and the aesthetic value of natural ecosystems. The increasing use of natural materials in professional landscape designs for parks and public places has reflected this change in public taste. Public reaction has been positive in areas where the floral display of wildflowers has been successful. In Texas, the showy roadside wildflowers have become a major tourist attraction.

Complaints have usually been received from the public when wildflower plantings have failed, when the surroundings are not suitable for wildflowers and when allergic concerns have been raised about invading weeds. Plantings have also appeared unsightly if not mowed in the fall after seed maturity (G. Lajeunesse, personal communication). In some cases, annual species produced a showy display in the first season, but generally fail to re-seed themselves. This created expectations that were not met in the subsequent years.

For these reasons, publicity concerning the potential beautification of the highway with wildflowers should be low-key in the beginning to avoid inflating public expectations.

The appearance of the surrounding landscape is a very important consideration in site selection (G. Lajeunesse, B.L. Harper, personal communication). Whether in rural or urban areas, planted wildflowers should "fit in" with the other vegetation to create the most natural looking landscape. Experience has shown that areas of well-groomed turf in high maintenance neighbourhoods should generally be avoided, since the public likely will feel that the site is simply not being

maintained to previous standards (G. Lajeunnesse, personal communication; Harper, 1988).

7.2 Adjacent Landowners

The impact of wildflowers on adjacent land must be considered in selecting wildflower sites. Generally, U.S. transportation departments have had very little negative reaction from adjacent landowners, likely due to careful site selection. All potential problems must be considered with respect to intensive crop production.

The Virginia DOT was careful to secure the official approval of the State Dept. of Agriculture before proceeding with wildflower planting, and to have specific approval for all wildflower species included in the program (R.L. Hundley, personal communication). Less aggressive species were chosen that were unlikely to invade neighbouring fields. Other states have not planted too close to fields or have left a 10 m unplanted zone near the fence line.

It is important to explain the project to and secure the cooperation of adjacent landowners before proceeding with wildflower plantings. Any location where wildflowers may be perceived as weeds that will lower property values, should be avoided.

8.0 PLANT MATERIAL

8.1 Species Selection Criteria

Roadside wildflower planting in the U.S. has emphasized the reintroduction of native vegetation, but most programs include some naturalized species as well.

Whether native or naturalized, species should be selected that are well-suited to the soil type, moisture, and shade conditions of the site. These appear to be among the most critical factors for successful wildflower establishment.

The Ontario Weed Control Act, 1988 lists several noxious weed species which must be destroyed by all landowners. Some wildflowers which are classified as noxious weeds are: Daucus carota (wild carrot, Queen Anne's lace) and Asclepias spp. (milkweed spp.). In addition, the Canada Seed Act classifies many other species as primary, secondary, or tertiary weeds, depending on whether they are toxic, add unpleasant flavours to milk, are difficult to eradicate, spread aggressively, or are simply considered "unsightly". These regulations limit the number of seeds of many species, such as ox-eye daisy, that may be present in any ground cover seed mixture. Commercial wildflower mixtures are not graded, since these are considered to be "flowers", not "ground covers" (R. Pettigrew, personal communication). Thus, although some of these species may be planted alone, there may be problems with adding seeds of certain wildflowers to regular grass/legume "ground cover" mixtures for hydroseeding on construction sites, as is done in some American states.

As well, the species should not be weeds of agricultural concern in the areas where they are planted. This could include invasive species, and ones that are disseminated by wind or wildlife. Provincial agricultural specialists should be contacted during the process of species selection.

The species that are selected should have showy foliage, flowers, and/or fruit (seed heads) that are visible to the travelling public. Mixtures should contain species of similar heights so that visibility of individual species is not impaired. Overall height of individual species and mixtures should be considered with respect to placement of wildflower plantings within a right-of-way. Species taller than 2 m should not be planted where they could limit visibility (generally within 30 m of the shoulder).

In the interest of reducing long term maintenance requirements, the plantings should be self-perpetuating. The use of hardy perennial species or ones that readily reseed is desirable. As well, the species should be competitive without being aggressive invaders.

Roadside conditions are very stressful in terms of generally poorly developed topsoils and low nutritional levels (particularly on construction sites) combined with arid, droughty conditions. Soil water levels range from well drained on banks and shoulder areas to wet in drainage channels. As well, in Ontario, roadside wildflowers should be tolerant of roadsalt.

Some naturally occurring wildflower species tolerate postemergence selective herbicides that have been used in highway right-of-way management. It may be possible to design wildflower mixtures that tolerate certain herbicides.

Certain wildflower species possess allellopathic properties that may be beneficial in controlling invading woody and herbaceous weeds. Certain goldenrod, aster and sunflower species possess allelopathic chemicals (Foster, 1984; Risser, 1969). These species may limit the number of compatible species in a mixture. As well, auto-allelopathy may be a problem for self-seeding in such stands.

Tables 1 and 2 list wildflower species that are native or naturalized in Ontario (Fernald, 1970). This list was summarized from the following sources:

- Wildflowers reported on roadsides in Algonquin Park (Strickland and LeVay, 1980).
- Species recorded in a disjunct prairie community on a railway right-of-way in West Hill (Toronto), Ontario (Catling and McKay, 1974; Roberts et al., 1977).
- Species recorded in various disjunct prairie communities in southern Ontario (Roberts et al., 1977).
- Species recorded on roadsides in Cattaraugus County in western New York State (Eaton and Schrot, 1987). They pointed out the adaptation to open conditions, various degrees of soil drainage, road salting, and herbicide application.
- Roadside wildflower program in Massachusetts (Massachusetts Dept. of Public Works, 1989).
- Roadside prairie restoration or wildflower programs in north central states (Landers, 1972; Ray, 1987; Salac et al., 1978; Schramm, 1968). Generally these wildflowers (forbs) have been established as part of roadside prairie communities.

Sullivan and Daley (1981) compiled a comprehensive list of wildflower species that have been evaluated in various regions of the United States. They have gathered information from researchers across the country on germination treatments, soil moisture requirements, and plant characteristics.

8.2 Sources of Plant Material

It is preferable to plant locally produced seed to avoid introducing new genotypes which may supplant the native gene pool, and to increase the potential longevity of plantings by using material well-adapted to local conditions. At present, however, little Ontario produced seed of native or naturalized species is available commercially. Most commercial seed mixtures use seed produced in the U.S. Mid- or Southwest, even when species occur naturally in Ontario. A list of commercially available species is presented in Appendix I. One firm, Mulligan Seeds Ltd., Ottawa, can currently supply small quantities of Ontario produced seed.

Seeds collected in Ontario from several populations of native perennial species in the Ottawa area have exhibited moderate germination rates (about 30-70%) after cold stratification treatments to overcome dormancy (J. Mulligan, personal communication). This suggests that seed collected in the wild could be planted directly in the right-of-way. Minnesota, Michigan, Nebraska, and Wisconsin have conducted similar germination tests on locally collected seed of several species (B.L. Harper, K. Herman, E. Ronis, personal communication). DOT's in these states have initiated research projects with University Horticultural

Departments and seed companies to develop and market a few local varieties, but relatively little seed is yet available commercially. Two seed companies in Minnesota now offer local seed, as do several small seed companies in Wisconsin. Similarly, if a market is available, it may be possible for Ontario seed companies to develop local varieties with higher germination rates over a 3 to 4 year period (W.R. Aimers, J. Mulligan, personal communication). A germination rate of at least 50-60% is estimated to be necessary for successful hydroseeding (Wildseed Inc., 1987; W.R. Aimers, personal communication).

9.0 OPTIONS FOR ONTARIO CONDITIONS

9.1 Natural Stands

Since natural regeneration has been a part of the Ministry's vegetation management program for over ten years, a program could be developed to encourage and manage wildflower communities that occur naturally on highway rights-of-way. Important aspects of this program would be:

1) Identification of wildflower (forb) and grass components of these communities.
2) Development of management practices to control invading herbaceous and woody weeds such as mowing or selective herbicide applications.
3) Investigations on management practices to expand these communities. These could include timing of mowing to promote reseeding, harvesting and spreading of wildflower hay, and fertilization of natural stands.
4) Investigations on the feasibility of wildflower (forb) enrichment in natural roadside communities by spot seeding or transplanting.

9.2 Establishing Wildflowers

Two approaches to wildflower establishment are: 1) prairie-like plantings of grasses and wildflowers (forbs) and 2) mass plantings of wildflowers as single species or mixtures. If grasses are incorporated into the mixtures, they could be nurse species, the standard species planted on roadsides or prairie grass species. The nurse crop should be non-competitive clump grasses such as fescues, sown at a low rate. The nurse crop stabilizes the soil and reduces the invasion of more aggressive weeds. Many prairie grass species have a clump growth habit which seems to be compatible with the growth of wildflower (forb) species.

Site Preparation

Site preparation and approaches to weed control must be considered for successful wildflower establishment. The site should be evaluated before being disturbed for existing weed species (including existing sod species). Any perennial species should be controlled using appropriate measures. Ideally, regrowth should be allowed and a second treatment made if the plants have survived. A suitable fallow period or planting of a highly competitive green manure crop in the year before planting would provide additional weed control. A green manure crop is an annual grain or legume species that competes with germinating weeds and provides additional organic matter in the soil. The current issue of the Ontario Guide to Weed Control (OMAF, 1990) discusses different site preparation strategies for perennial crops. One important strategy may simply be to avoid areas where problem perennial weeds have been established.

A second concern is competition from germinating weeds in the first year of the planting (Lander et al., 1968). One approach is to disturb the site as little as possible before planting. Existing vegetation or sod may be killed with a broad spectrum postemergence herbicide that leaves no soil residue followed by no-tillage seeding techniques such as drill or slit seeding. Herbicides such as glyphosate (Roundup) may take as long as 14 days to inactivate in killed sod (Moshier and Penner, 1978). One to three mowings may be necessary to reduce the height of existing sod to 2.5 to 4 cm (Wildseed, 1988). Flail mowing may also be used (Ahern, personal communication).

If the planting is being made in a construction site or prepared land, some method of weed control should be considered. It may be advisable to delay planting wildflowers for a year to allow control of germinating weeds. On construction sites, providing a vegetative cover is important to prevent erosion. A grain or legume green manure crop could be planted in the first year and wildflower planting could be delayed until the second year. In the year of planting, a stale seedbed technique could aid in control of germinating weeds. Weeds are allowed to emerge and then controlled by mechanical or chemical means before seeding. As well, the use of selective preemergence or postemergence herbicides could be evaluated for wildflower species.

Planting Techniques

Seeding on established turf or bare ground (construction fill) will require different planting techniques. Methods include transplanting, broadcast seeding, hydroseeding, or drill seeding. The choice of

method will depend on the size and accessibility of the site, as well as the soil type and previous ground cover.

Transplanting:

Wildflower plugs or transplants may be transplanted by hand in small areas, either directly into a prepared bed or a prepared spot in existing turf (Nuzzo, 1978). The success rate for establishment is high and local varieties of native species are available. However, since the material is expensive and the process labour-intensive, this technique is suitable for small areas only.

Broadcast seeding:

Suitable for prepared sites. May be by hand or cyclone-seeder; useful for small areas. Small seed may be mixed with damp, fine sand for a more even distribution. Seed should be lightly raked into the soil and the ground should be rolled for best results. Light seed may wash away in heavy rains.

Drill seeding:

Suitable for killed sod or prepared sites. Seeder must be calibrated for different sizes or mixtures of seed. Use a range-land grass drill, such as the J-Thom 42 Wildseeder, with a "no-till" attachment. Good germination is achieved so less seed is needed, but drill seeded plantings have a less natural appearance. When planting single species, very small seed may be mixed with fine sand.

Hydroseeding:

Suitable for prepared sites. Seed is applied in a slurry with hydraulic mulch. Hydroseeder must be clean of other seed. This method is easiest for large areas, but results in the lowest establishment rate because of relatively poor soil-seed contact. After germination, small seedlings may have difficulty in penetrating the mulch, particularly under dry conditions.

Wildflower Hay:

This method was used in Texas for many years until commercial seed became widely available. Existing wildflower stands are cut in the fall once seeds are mature. The cutting is collected as hay, stored over winter in a dry place, and spread over the planting site in either spring or fall. This process is not presently recommended due to the lack of large natural stands of wildflowers in Ontario which are accessible and the risk of depleting natural stands. If right-of-way plantings become well established in the future, however, it may be possible to harvest them periodically for hay without depleting the stand. Germination rates may decline as a result of storage.

Site Selection Criteria

1) Sunny, open areas but not subjected to high winds.
2) Well-drained, coarse-textured soil such as sandy loams, sandy clay loams, or gravelly clay loams.
3) Adjacent land not containing woody or unwanted herbaceous species likely to invade the wildflower area.

4) High visibility for drivers but not in dangerous areas.

5) Surroundings aesthetically appropriate to wildflowers.

6) High traffic volumes (e.g., tourist routes, theme parkways), or slower traffic speeds (e.g., parks, rest areas, interchanges, entrances to towns), for visibility.

7) Plantings on back slopes or interchanges should not interfere with snow removal or drainage ditches.

8) Accessible for planting and maintenance practices.

9) Consideration given to adjacent land use, i.e., very little risk of diminishing property values or causing weed infestations on farm land.

10) Sites removed from shoulder so that they do not receive heavy salt spray or splash in winter.

Expressways and Series 400 highways may also be suitable for planting either in the median or the right-of-way. These plantings would need to be larger than those on secondary highways for visibility.

9.3 Maintenance Requirements

Wildflower plantings in Ontario have not been found to be indefinitely self-sustaining without some maintenance. A yearly fall mowing after seed matures may both improve the appearance of the site and ensure good seed-soil contact for spring germination. Mowing is usually done after the first freeze (late October-November) and to a height of approximately 12-15 cm (G. Lajeunesse, personal communication). Plantings in Michigan, however, have now been established for three seasons without mowing. Mowing could be done on a less frequent basis to control invading woody weeds.

Spot-spraying for noxious weeds and woody species may be necessary by the third growing season even when precautions have been taken to rid the seed bed of rhizomes and weed seeds before planting. The extent of the weed problem will vary depending on the proximity of seed sources to the plot and rate of growth of the wildflowers. Plantings should be inspected each year.

Over-seeding or renovation of plantings may be necessary by the fourth or fifth year. Usually there is a natural succession of dominant perennials in the plot and over-seeding may be desirable to enhance variety. The problem of certain species dying out may be due to the use of species which may not be well adapted to Ontario conditions. However, the Texas DOT reports that wildflower plantings often need to be re-seeded two or three times during the first 5-6 years, after which they become self-sustaining. Nevertheless, a long term commitment to the necessary maintenance of these areas is essential for success.

10.0 COSTS/BENEFITS OF WILDFLOWER PROGRAM FOR MTO

It is difficult to generate even approximate cost figures for planting and maintenance of wildflowers, since costs will vary greatly depending on the seed source, the frequency of mowing and spraying that is necessary for maintenance, and the method of planting that is appropriate to the site. Similarly there is no "typical" cost of maintaining a hectare of right-of-way in a grass/legume mix, since maintenance can vary from zero to up to 3 mowings per year and spraying may be regular or intermittent.

Nevertheless, it is suspected that wildflowers will be somewhat more expensive to plant and maintain than an equivalent area of grass/legume mix. Commercial wildflower seed, for example, is more expensive that grass seed. Some savings may be realized, however, if wildflowers can be planted in the rights-of-way which now receive a high level of maintenance, without harming the appearance of the highway. Results with test plots should help to better estimate costs.

Wildflowers confer other benefits, however, such as beautification of the highway, added colour to break up the monotony of grass, increased public awareness of the value of the natural environment, and increased enjoyment of Ontario highways by tourists and other drivers. Although the cost of installation may be relatively high, wildflowers, once established, should require little maintenance and be self-sustaining for many years. Planted wildflowers may also prevent the growth of other, less desirable weeds and may prove useful in erosion control on slopes with thin, rocky soil where grass is not easily established.

11.0 INVOLVEMENT OF COMMUNITY GROUPS IN ROADSIDE WILDFLOWER PLANTING

A number of groups have expressed interest in participating in wildflower plantings in some way. In 1986, Eastern Region and Kingston District landscape personnel inquired about the feasibility of planting wildflowers along a section of the Loyalist Parkway, Highway 33, near Kingston. Subsequently, the Garden Club of Toronto expressed interest in supporting roadside wildflower plantings in Ontario. A 1988 issue of "Wildflower" magazine, dedicated to roadside wildflowers, encouraged

local nature and garden clubs to "work out a joint plan with the local road authorities in your area to begin roadside wildflower restoration" (Hodgins, 1988).

11.1 Summary of U.S. Experience

In all states surveyed, the majority of wildflower planting has been done by contractors or Department of Transportation personnel. Nevertheless, several states have recently begun to involve volunteers in wildflower and other landscaping programs. The degree of public participation allowed by each state has varied from providing information and requests for plantings, to collection and donation of plant material, to actual planting and maintenance work in the right- of-way.

The first large-scale use of volunteer workers in highway rights-of-way was the Texas "Adopt-a-Highway" litter clean-up program started in 1985. This program has become very popular, and signs (Appendix 2) provided an inexpensive form of publicity for the groups involved. Subsequently, both Texas and California began involving community groups in landscaping operations in 1986 and have now committed to this approach on a large scale. By 1988, Texas aimed to have 50% of new wildflower plantings handled by volunteers. California had also encouraged business and community groups to plant and maintain sections of highways, including freeway interchanges, with landscape plantings (Kress, 1987). Similarly, in 1988 Virginia began a volunteer planting program modeled on that of Texas, involving ornamentals for beautification.

Volunteer groups working in the rights-of-way must be insured and obtain permits from the state. Individuals must sign waivers of DOT responsibility for injury to participants, and follow strict written guidelines and safety regulations. Volunteer workers are generally not allowed on controlled-access highways, or in areas of high traffic volume. Examples of the permits and guidelines issued by the Virginia DOT can be found in Appendix II. Another example is contained in "Encroachment Permit Information" published by the California DOT (3). Planting is usually supervised by DOT personnel. By legal agreement, maintenance is undertaken by either the DOT or the volunteer group for a specified period of time.

Other states have questioned the merits of using volunteer workers. Massachusetts, Ohio, and Michigan have decided not to actively encourage the participation of community groups on a large scale, but have allowed a few selected groups and horticultural societies to plant wildflowers in the right-of-way as a result of unsolicited proposals. Decisions to approve these projects have been made on a case-by-case basis. Minnesota and Nebraska have had no volunteers participating in planting or maintaining roadsides at present, although Minnesota may consider this in the future.

Some states have limited public participation in wildflower planting due to various concerns. In some cases garden clubs and horticultural societies have been primarily interested in planting ornamentals for beautification, not in establishing wildflowers. As well, many civic groups have lacked the technical expertise to successfully establish

wildflowers. Michigan has found that wildflower planting proved too expensive for most local community groups and that most were unable to provide the level of seed quality and type of cultural program that the Department felt was necessary for successful wildflower establishment. The MDOT has, however, initiated a program with the non-profit Michigan Wildflower Society to develop sources of local seed of native species.

In some cases it was felt that the cost savings of involving community groups on a large scale in landscaping with either wildflowers or cultivated plants were outweighed by the administrative problems of managing and supervising volunteers There were also concerns about potential conflicts between volunteers and highway department personnel, since members of the volunteer groups would have little understanding of highway maintenance policies and procedures.

There has been a continuing concern about the legal liability of transportation departments in the face of injury to volunteer workers in the right-of-way, despite research by their legal departments and the inclusion of waivers and insurance requirements in agreements. Since volunteer programs have been underway for only a short time, there are few precedents. In Texas, however, no lawsuit has ensued as a result of the death of a child who was struck by a car while accompanying a parent at an "Adopt-a-Highway" site, and the popularity of the program has not been diminished.

Some states have concluded that the safety risk to volunteers is too great to allow any group that offers to operate indiscriminately in the

right-of-way. Nevertheless, projects by selected community groups have been permitted under supervision and with enforcement of safety guidelines.

11.2 Ontario Experience

Although several municipal parks in Ontario and Ontario Hydro have planted wildflowers in the last few years, none of this work has involved volunteers. However, the Ontario Ministry of Transportation (MTO) has occasionally allowed community groups or developers to plant trees, shrubs, and other ornamentals in the right-of-way within municipal limits or in specially designated locations. Litter collection and other special projects, such as charity walks, have also been allowed. In these cases, short-term encroachment permits have been issued to local groups who request use of the right-of-way for a specific purpose.

11.3 Possible Public Participation in Wildflower Plantings

Public groups could be involved in the planting and maintenance of wildflowers, but it would be important for the Ministry to be aware of the cultural requirements and long term maintenance of wildflower plantings so that guidance could be provided to interested groups and so that provision for care could be included in any agreements.

One area of potential involvement by interested groups would be seed collection and development of local sources of wildflower seed. As indicated, similar programs have been initiated in Michigan. Once suitable species have been identified for roadside plantings this area could be explored.

Such programs should ensure that native stands are not decimated. Other concerns include the quality of collected seed in terms of identity, purity, viability and seed vigour. As well storage and seed treatment facilities would be required. It would be important that such a program be set up only after consultation with specialists in the field.

Volunteer participation could take the form of:

1. Advice on plant species.
2. Requests for planting.
3. Donations of approved wild or commercial seed or other plant material.
4. Locating native populations of wildflowers and woody species and collecting seed and plant material.
5. Planting and maintenance work in the right-of-way.

The type of groups that may be interested are:

- Civic and community groups
- Service clubs
- Horticultural societies and garden clubs
- Conservation groups

11.4 Impact of Volunteer Involvement in Wildflower Plantings

Advantages:

1. Reduced cost for plant material and labour.
2. Employment of labour-intensive planting techniques, such as transplanting of wildflowers or the use of horticultural varieties that require more intensive maintenance.

3. Recognition of civic and community groups if signing of landscaped areas is employed.
4. Enhanced public image of MTO.

Disadvantages:

1. Potential for injury to non-Ministry personnel working in the right-of-way; MTO may be liable.
2. Cost to Ministry to prepare agreements, review proposals, issue permits, prepare planting specifications and safety guidelines, supervise plantings, and erect signs.
3. Certain groups may be interested but lack the personnel, resources, and expertise to carry out their plan; MTO will have to refuse some requests.
4. Groups may not maintain quality standards for plant material and installation.
5. Potential complaints and conflicts, e.g. Ministry personnel may accidentally cut or spray an area planted by a volunteer group.
6. A group's enthusiasm or budget may diminish after 2 or 3 years and maintenance be neglected.
7. Ministry must be prepared to take over or destroy any planting that is neglected.

The program in Ontario could be modeled on those of Michigan, Ohio, and Massachusetts. In these states, the general public is not encouraged to work in the right-of-way on a large scale, but responsible local groups who have the resources are allowed to plant and maintain sections of the roadside under various contractual arrangements.

Volunteer involvement in wildflower planting would have different requirements as compared to planting trees, shrubs or other horticultural plantings. Wildflowers, for example, may require periodic weeding and re-seeding, and may take up to 5-6 years to become well established and self-sustaining. Detailed plans would have to be submitted in advance for Ministry approval, and the Ministry must reserve the right to alter or remove any planting at any time. Wildflower planting requires patience and a long-term commitment to maintenance.

The area of encroachment permits, safety guidelines, Ministry supervision of operations, cooperation of Ministry maintenance staff, planting specifications and signage would have to be addressed before volunteer plantings could be considered.

12.0 RECOMMENDATIONS

Experience in other jurisdictions suggest that roadside wildflower planting is technically feasible in Ontario and has potential benefits such as natural aesthetics, options for ground covers, and reduced long term maintenance. However, there are concerns about species selection, weed control, and establishing self-sustaining plantings that need to be addressed before a general wildflower program can be considered. The following recommendations address these concerns:

1) Address wildflower establishment by:
   - management of naturally occurring stands
   - seeding or planting of either wildflower communities or grass and wildflower (prairie) communities.

2) Proceed initially as a research project to address technical concerns.

3) Species selection should consider native or widely naturalized species. Provincial weed specialists should be consulted to avoid selecting species that could present weed problems for adjacent landowners.

4) Research should address problems of weed control and establishing self-sustaining plantings.

5) Research should be done in different climatic regions in the province, since certain species may have limitations in terms of soil type, rainfall requirements, growing season, and winter hardiness.

6) Various interest groups should be contacted during the course of the project to communicate the purpose of the research and to identify potential concerns.

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1697 West 2100 North
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APPENDIX 1

WILDFLOWER SPECIES

Table 1: Perennial wildflowers that are native to Ontario[1], that have been recorded or planted on roadsides, or recorded in Ontario tallgrass prairie communities

Scientific Name	Common Name	Height[2] (cm)	Soil Moisture[2] Regime	Source[3]
Anaphalis margaritacea	pearly everlasting	30 - 60	mesic	8
Anemone cylindrica	long-headed thimbleweed	30 - 70	mesic - dry	4
Antennaria neglecta	pussey toes	5 - 30		5
Apocynum androsaemifolium	spreading dogbane	30 - 120	dry	8
Aster azureus	azure aster	10 - 100	mesic - dry	4
A. ericoides	heath aster	20 - 200	mesic - dry	2,4,5
A. laevis	smooth aster	30 - 100	mesic - dry	2,4,5
A. nova-angliae	New England aster	to 250	moist - mesic	3,6
A. ptarmicoides	upland white aster	10 - 60	dry	4
Baptisia leucantha	white false indigo	to 15	mesic	7
Campanula rotundifolia	harebell	15 - 40	mesic - dry	4
Cichorium intybus	common chicory	30 - 150[5]	---	3,8
Coreopsis lanceolata	sand coreopsis	30 - 60	dry	3
Desmodium canadense	showy tick trefoil	60 - 120	mesic	2,7
Epilobium angustifolium	fireweed	10 - 200	mesic - moist	8
Euphorbia corollata	flowering spurge	50 - 100	moist - dry	4
Fragaria virginiana	wild strawberry	12 - 20	moist - dry	5
Geum aleppicum	yellow avens	30 - 150[1]	---	1,4
Helianthus laetiflorus	showy sunflower	15 - 250	moist - dry	2
H. l. var. rigidis	stiff sunflower	15 - 250	dry	7
Heliopsis helianthoides	false sunflower, ox-eye	30 - 150	mesic	4,7
Krigia biflora	two-flowered eynthia, false dandelion	20 - 70	mesic	5
Lespedeza capitata	round-headed bush clover	60 - 120	mesic - dry	2,5,6,7
Liatris spicata	gayfeather, spike blazing star	30 - 180	wet - mesic	3,5
Lithospernum canescens	hoary pucoon	10 - 45	moist- dry	5
Lobelia spicata	spiked lobelia	20 - 110	mesic - dry	5
Lysimachia quadrifolia	narrow-leaved loosestrife	20 - 90	wet - moist	5
Monarda fistulosa	showy wild bergamot	60 - 90	wet - dry	4
Penstemon gracilis	slender beard-tongue	20 - 40	dry	4
Phlox divaricata	sweet william phlox, blue phlox	15 - 40	moist	6

Table 3. Perennial wildflowers that are native to Ontario[1], that have been recorded or planted on roadsides, or recorded in Ontario tallgrass prairie communities (cont'd)

Scientific Name	Common Name	Height[2] (cm)	Soil Moisture[2] Regime	Source[3]
P. maculata	wild sweet william	30 - 90[1]	mesic-moist[1]	1
P. pilosa	prairie phlox	10 - 75	mesic	6
Potentilla arguta	tall cinquefoil	30 - 100	mesic - dry	4
Prunella vulgaris	healall	5 - 60	---	5,8
Pycnanthemum virginianum	mountain mint	30 - 100	moist - dry	7
Ratibida pinnata	greyhead prairie coneflower, yellow coneflower	50 - 150	dry	2,4,6,7
Silphium terebinthinaceum	prairie dock	100 - 300	mesic - dry	7
Solidago altissima	tall goldenrod	70 - 200	moist - dry	2
S. canadensis	Canada goldenrod	30 - 150	moist - dry	3,8
S. juncea	early goldenrod	60 - 130	dry	5
S. nemoralis	gray goldenrod, field goldenrod	15 - 100	dry	4
S. ohioensis	Ohio goldenrod	30 - 90	wet - moist	5
S. rigida	stiff goldenrod	30 - 150	mesic - dry	2,7
S. speciosa	showy goldenrod	60 - 200	moist - dry	4
Verbena stricta	hoary vervain	30 - 120	mesic - dry	4
Veronicastrum virginicum	culver's root	100 - 200	wet - mesic	5,7
Zizea aurea	golden alexanders	30 - 100	moist	5

1
2 Reference: Fernald, 1970
3 Reference: Sullivan and Daley, 1981
Sources:
1 - Eaton and Schrot, 1987
2 - Landers, 1972
3 - Mass. Dept. of Public workds, 1989
4 - Ray, 1987
5 - Roberts et al., 1977
6 - Salac et al., 1978
7 - Schramm, 1968
8 - Strickland and LeVray, 1980
4
5 Fernald (1970) indicated that G. a. var. stritum is native but G. a. is not
Alex and Switzer

Table 2: Perennial wildflowers that are naturalized in Ontario[1] that have been recorded or planted on roadsides, or recorded in Ontario tallgrass prairie communities

Scientific Name	Common Name	Height (cm)[1]	Source[2]
Achillea millefolium	yarrow	30 - 100	2,4
Chrysanthemum leucanthemum	ox-eye daisy	30 - 100	2,4
Echium vulgare	blueweed	30 - 90	4
Hemerocallis fulva	day lily	50 - 200[3]	1
Hieracium aurantiacum	orange hawkweed	20 - 70[3]	4
H. florentinum	king-devil hawkweed	15 - 100[3]	3
Hypericum perforatum	common St. John's-wort	30 - 90[3]	4
Hypochaeris radicata	cat's-ear	20 - 40[3]	1
Linaria vulgaris	toadflax	to 130	4
Lotus corniculatus	bird's-foot trefoil	low, spreading[4]	1,4
Potentilla argentae	silvery cinquefoil	10 - 50	4
Ranunculus acris	common buttercup	10 - 150	4
Sedum purpureum	live-forever	20 - 80	1
Vicia cracca	purple vetch	spreading or climbing[4]	4

[1] - Reference: Fernald, 1970

[2] - Sources: 1 - Eaton and Schrot, 1987
2 - Mass. Dept. of Public Works, 1989
3 - Roberts et al., 1977
4 - Strickland and LeVray, 1980

[3] - Height of flower stem (scape)

[4] - Reference: Alex and Switzer

Table 3: Commercially available wildflowers (1988)

Achillea sp.	gold yarrow
Achillea millefolium	common yarrow
Alyssum maratinum	sweet alyssum
Anaphalis margaritacea	pearly everlasting
Anenome canadensis	Canada anenome
Aquilegia canadensis	wild columbine
Asclepias tuberosa	butterfly-weed
Aster sp.	blue aster
Aster novae-angliae	New England aster
Campanula rotundifolia	harebell
Chrysanthemum leucanthemum	ox-eye daisy
Coreopsis lanceolata	lance-leaf coreopsis
Echinacea purpurea	purple coneflower
Epilobium angustifolium	fireweed
Iris versicolor	flag iris
Lobelia cardinalis	cardinal flower
Lotus corniculatus	bird's-foot trefoil
Lupinus perennis	wild lupine
Lythrum salicaria	purple loosestrife
Monarda fistulosa	wild bergamot
Oenothera biennis	evening primrose
Phlox divaricata	blue phlox (sweet william)
Physostegia virginiana	obediance
Rudbeckia hirta	black-eyed Susan
Saponaria officinalis	bouncing bet
Solidago sp.	goldenrod
Thalictrum polygamum	tall meadow rue
Verbena hastata	blue vervain

APPENDIX II

NOXIOUS WEEDS, ONTARIO

The weeds named below are classified as noxious weeds in Ontario under The Weed Control Act, 1988[1].

Scientific Name	Common Name
Ambrosia spp.	ragweed species
Asclepias spp.	milkweed species
Barbarea spp.	rocket, yellow
Berberis vulgaris	barberry, common
Carduus spp.	thistle, nodding, species
Centaurea spp.	knapweed species
Cirsium arvense	thistle, Canada
C. vulgare	thistle, bull
Conium maculatum	hemlock, poison
Cuscuta spp.	dodder species
Daucus carota	carrot, wild
Euphorbia cyparissias	spurge, cypress
E. esula	spurge, leafy
Lathyrus tuberosus	vetchling, tuberous
Onopordum acanthium	thistle, Scotch
Panicum miliaceum (black-seeded biotype)	proso millet, black-seeded
Rhamnus cathartica	buckthorn, European
Rhus radicans	poison-ivy
Salsola pestifer	thistle, Russian
Sonchus spp.	sow-thistle, annual, perennial
Sorghum halepense	Johnson grass
Tragopogon spp.	goat's-beard species
Tussilago farfara	colt's-foot

[1] Govt. of Ontario, 1988. Weed Control Act, 1988. Dennis P. Caplice, Queen's Printer for Ontario, Toronto.

APPENDIX III

VIRGINIA DEPARTMENT OF TRANSPORTATION, 1987 GUIDELINES RELATIVE TO PERMITS FOR PLANTING WITHIN THE RIGHT-OF-WAY

VIRGINIA DEPARTMENT OF TRANSPORTATION, 1987

Guidelines Relative To Permits For
Planting Within The Right-of-Way

1. All requests to plant within the right-of-way shall be made to the Resident Engineer's office.

2. Upon receiving a request to plant, the Resident Engineer will transmit a "Planting Agreement" to be filled in and signed by the applicant's authorized representative.

3. The Planting Agreement, along with a sketch showing the location and type of planting, shall be returned to the Resident Engineer. The sketch shall conform to the Department's "Guidelines for Planting on Virginia's Roadways".

4. The Resident Engineer, along with the District Engineer's and Environmental Engineer's representatives, shall jointly review the proposed planting.

5. After favorable approval is received, the installation of the material may proceed.

The following represents the "Planting Agreement" forms that are available to be issued to the permittee.

"Planting Agreement A" indicates that the permittee will supply the plant material to the Department for planting.

"Planting Agreement B" indicates that the permittee will be allowed to install the plant material. Specific safety guidelines may also be required.

PLANTING AGREEMENT A

Date _____ District _____ County _____

In an effort to secure a more pleasing appearance on the roadsides between

_____

and _____

on Route ____, the _____

_____

agrees to furnish the nursery stock as outlined on the attached sketch, which is made a part of this agreement.

In accepting the above, the parties agree to the following:

1. The permittee shall furnish all plant material to the Department or have it delivered to the job site. This plant material shall comply to the AAN Standards and with the state and federal laws that pertain to inspection for plant diseases and insect infestation.

2. If requested, the Department will place an order with a nursery for the plant material with the understanding that the invoice is to be sent to the permittee.

3. The Department will plant the material as outlined on the sketch.

4. The Department will maintain the plant material; however, the Department cannot be expected to provide maintenance such as that given a front yard or garden, but will maintain the plantings within its labor and funding limitations. The permittee or interested groups may be permitted to maintain special areas.

5. When plants or funds are available for such purposes, the Department will undertake to replace any material that may die.

6. If the plant material allowed under this agreement becomes a traffic hazard (as determined by the Department), the Department may remove such planting.

The Department reserves the right to specify plant material that require a minimum of maintenance.

Every effort will be made to locate the material in such a manner as to be outside the limits of future construction. In the future, should such material obstruct construction, it will be relocated only if economically practical.

Special Provisions: _____

_____

_____

The above conditions are agreed upon.

Name _____

Signed by _____

Title _____

Address _____

_____

Phone Number _____

Recommend Approval:

_____ _____

Date Resident Engineer

Approved:

_____ _____

Date District Engineer

_____ _____

Date Environmental Engineer

PLANTING AGREEMENT B

Mr. _____ Date _____

Resident Engineer

Virginia Department of Highways and Transportation County _____

_____

_____

Dear Mr. _____:

We, the undersigned, wishing to cooperate with the Virginia Department of Highways and Transportation (hereinafter referred to as the Department), request permission to _____

_____

between _____

and _____

on Route _____.

In requesting this permission, the following provisions are agreed to:

1. Any planting proposed shall be outlined clearly and a sketch of same made a part of this Agreement.

2. The applicant assumes the responsibility for the completion of the work outlined.

3. The applicant agrees to indemnify and save harmless the Department, the Highway and Transportation Board, and all its officers, agents and employees from all suits, actions of claims of any character, name or description which might arise from the construction of work permitted by this Agreement.

4. It is understood that should any planting allowed under this agreement become a traffic hazard, in the opinion of the Department, at its discretion the Department may remove such planting.

Name _____

Signed by _____

Title _____

Address _____

_____

Phone Number _____

Recommend Approval:

_____ _____

Date Resident Engineer

Approved:

_____ _____

Date District Engineer

_____ _____

Date Environmental Engineer

VIRGINIA DEPARTMENT OF TRANSPORTATION

ADOPT-A-HIGHWAY BROCHURE W/SAFETY TIPS

Virginia is a beautiful state, and it boasts one of the best highway systems in the country. We encourage visitors from all over the world to tour the Old Dominion, but the most scenic drive can be ruined by the sight of trash strewn along the roadside.

Not only is trash unsightly, it's also expensive! It costs several million dollars in state highway funds each year to pick up litter. That money could be better spent repairing potholes, removing snow, cutting grass and keeping our roads in good shape.

How can you help keep Virginia beautiful and save highway maintenance money for more critical jobs? You can volunteer to "adopt" a highway!

The Adopt-A-Highway progam has been developed by the Virginia Department of Transportation, in cooperation with the Virginia Division of Litter Control and Recycling and Keep Virginia Beautiful, Inc., to encourage Virginia's citizens to take part in keeping their state's roads free of trash.

To adopt a highway, individuals, organizations or businesses agree to keep approximately two miles of selected highway cleared of litter for a two-year period. In exchange, volunteers are given materials to help them with the pickups, and a sign bearing their name will be posted at the beginning of their adopted section of highway. At the end of the two-year period, the volunteers will receive a special certificate of appreciation and may renew their agreement.

If you're interested in adopting a highway, contact your local VDOT residency or litter control office for more details -- their numbers are in your local phone book.

ADOPT-A-HIGHWAY SAFETY TIPS

DON'T walk in or close to the edge of the highway travel lanes or on any medians. Stay on the right of way facing the traffic, and stay with your team.

DON'T horse around or do anything that will distract passing drivers or other volunteers.

DON'T work during peak travel times when many cars will be passing. VDOT will help identify suitable times.

DON'T participate in a litter pickup while under the influence of drugs and/or alcohol.

DON'T overexert yourself.

DON'T pick up litter in construction or maintenance sites.

DON'T pick up hazardous materials. Contact the State Police or the Hazardous Waste Hotline (1-800-552-2075).

DO carpool to the pickup site to keep a minimum of cars on the right of way.

DO wear an orange safety vest so you can be seen easily.

DO wear light- or bright-colored protective clothing, as well as hard-soled shoes and work gloves.

DO work only during daylight hours and fair weather.

DO stay alert for snakes and noxious weeds.

DO lower the orange safety sign before you begin the pickup and secure it back in place when you're through.

DO take pride in what you're doing to keep Virginia beautiful.

TAKE PRIDE IN VIRGINIA -- ADOPT A HIGHWAY!

36" x 24"
BLUE/WHITE
LEGEND
2"D U.C. LETTERS

30" x 30"
ORANGE/BLACK
LEGEND
(SAMPLE TEXT - MAY
VARY)
HINGED FOR FOLD UP